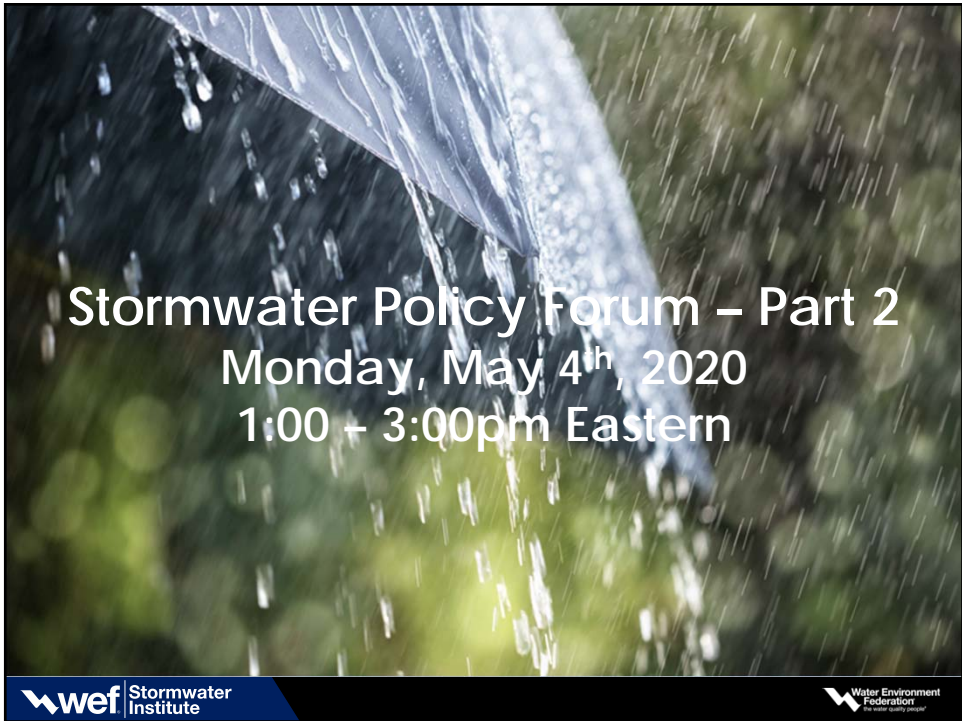




1



2

Welcome

- **Scott Taylor, P.E., D.WRE**

- SWI Advisory Committee Vice-Chair
- Senior Vice President, Michael Baker, International
- National Municipal Stormwater Alliance Chair



3

Today's Webcast Agenda

Keynote Speaker

- Mark S. Osler, Senior Advisor for Coastal Inundation and Resilience, National Oceanic and Atmospheric Administration
- Discussion/Q&A

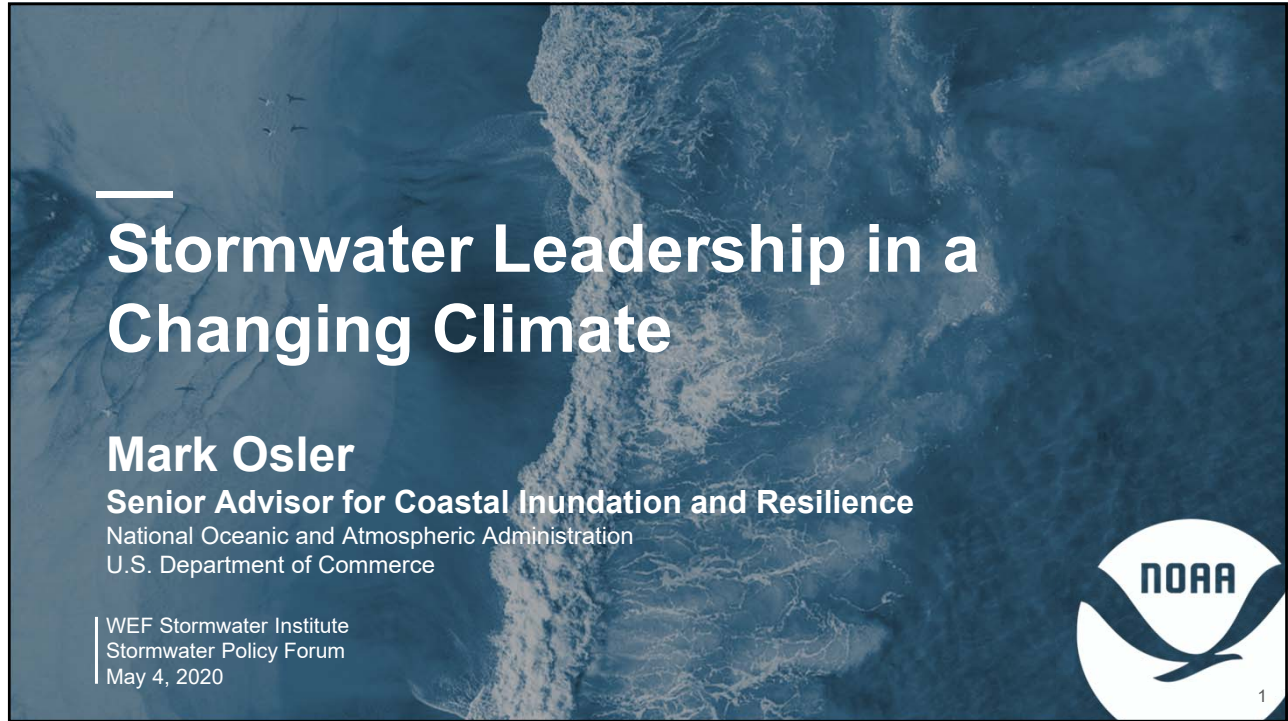
Hot Topics Panel

- Sonia Brubaker, Director, Water Infrastructure and Resiliency Finance Center, U.S. EPA
- Christopher D. Pomeroy, President, AquaLaw PLC
- Steven Rowe, President and Chief Executive Officer, Newtrient LLC
- Jason R. Masoner, Research Hydrologist, U.S. Geological Survey Oklahoma-Texas Water Science Center
- Discussion/Q&A

Open Discussion, Feedback, and Forum Summary

- Scott Taylor
- Adriana Caldarelli, WEF Stormwater Institute Director


4



Stormwater Leadership in a Changing Climate


Mark Osler
Senior Advisor for Coastal Inundation and Resilience
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

WEF Stormwater Institute
Stormwater Policy Forum
May 4, 2020




1

1



Outline

1. NOAA and Audience Background
2. WEF and NOAA
3. 3 Things You Must Know
4. Q&A



2

2



Science.
To understand and predict changes in climate, weather, oceans, and coasts.

Service.
To share that knowledge and information with others.

Stewardship.
To conserve and manage coastal and marine ecosystems and resources.




3

Audience Background

I work in...

- A. the public sector
- B. the private sector
- C. an NGO
- D. academia



4


WEF and NOAA

a track record of collaboration



5

5



U.S. Climate Resilience Toolkit

Steps to Resilience Case Studies Tools Expertise Regions

Topics > Water > Water Resources Dashboard >

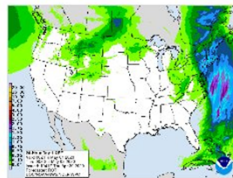
Forecasts, Outlooks, and Future Projections



National Weather Service Forecasts

View current conditions and short- to medium-range (1-7 days) forecasts for precipitation, temperature, wind, and clouds. These forecasts often identify potential hazards such as heavy precipitation three or more days in advance.

[Visit data source >](#)



Quantitative Precipitation Forecasts

View forecasts of cumulative precipitation for periods from 6 hours to 7 days into the future. Monitoring this site can alert decision makers of the potential for wet weather and/or flooding.

[View tool demo >](#)

[Visit data source >](#)



National Water Model (NWM)

The National Water Model (NWM) forecasts streamflow for the contiguous United States. The system models processes such as snowmelt and infiltration to determine how much precipitation forecast by NWS will become runoff, and then simulates discharge levels.

[View webinar about the tool >>](#)



6

6

This system has coastal tailwater...time to calculate tides and sea level rise.

Which picture best describes how you are feeling?



I got this.

A



ugh...if I must.

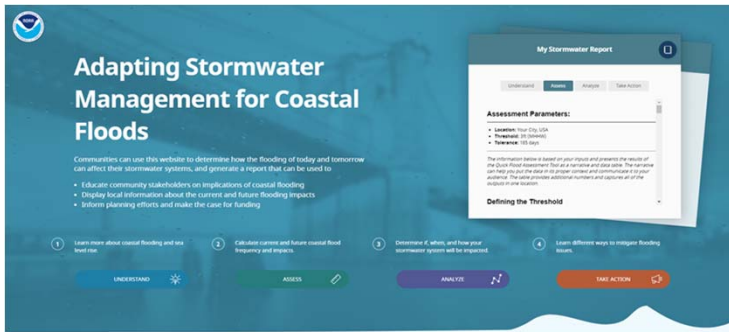
B



Get me outta here!

C

Adapting Stormwater Management for Coastal Floods



Provides information, tools, methods to examine:

- flooding from coastal inundation
- impacts on community-level stormwater issues
- when and where users might expect to see impacts
- what communities can do about it



3 things you must know

leadership challenges: from my world to yours



9

9

climate vs. weather

this is thing 1

advocate for the science you need



10

10

NOAA's Atlas 14 is ...

(I) mandated and federally funded (II) incorporates climate change impacts to precip

- A. (I) only
- B. (II) only
- C. neither (I) or (II)
- D. both (I) and (II)



11

11

make a bigger tent

this is thing 2

diverse partnerships lift all boats



12

12

integrated water management

this is thing 3

stormwater leadership = climate adaptation



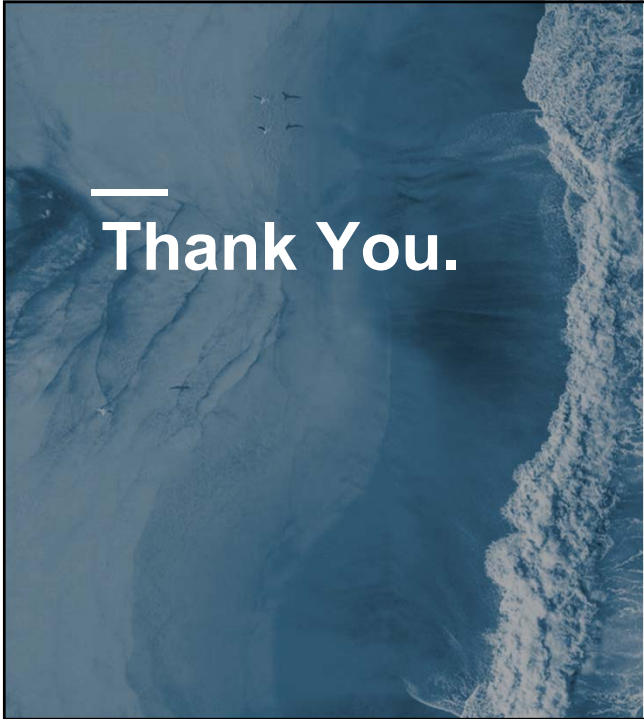
13

three things

1. advocate for the science you need
 2. diverse partnerships lift all boats
 3. stormwater leadership = climate adaptation
-




14



—
Thank You.

Mark Osler
Senior Advisor for Coastal Inundation and Resilience
mark.osler@noaa.gov

 **National Oceanic and Atmospheric Administration**
U.S. Department of Commerce

15

Hot Topics Panel

- **Sonia Brubaker**, Director, Water Infrastructure and Resiliency Finance Center, U.S. EPA
- **Christopher D. Pomeroy**, President, AquaLaw PLC
- **Steven Rowe**, President and Chief Executive Officer, Newtrient LLC
- **Jason R. Masoner**, Research Hydrologist, U.S. Geological Survey Oklahoma-Texas Water Science Center
- **Discussion/Q&A**

A graphic for the Stormwater Infrastructure Finance Task Force. It features a large, dark teal circular brushstroke on the left side. Inside the white space of the circle, the text reads: "Stormwater Infrastructure Finance Task Force", "May 4, 2020", and "Sonia Brubaker U.S. EPA".

Stormwater Infrastructure Finance Task Force

May 4, 2020

Sonia Brubaker
U.S. EPA

1

A graphic for the Water Infrastructure and Resiliency Finance Center. It has a dark blue header with the text "WATER INFRASTRUCTURE AND RESILIENCY FINANCE CENTER". Below the header, it states: "EPA's Water Finance Center helps local leaders make informed drinking water, wastewater, and stormwater infrastructure decisions." Below this text are four icons in circles: a magnifying glass (Research), two speech bubbles (Advise), a calculator (Innovate), and two hands shaking (Network). At the bottom is the URL: <https://www.epa.gov/waterfinancecenter>.

WATER INFRASTRUCTURE AND RESILIENCY FINANCE CENTER

EPA's Water Finance Center helps local leaders make informed **drinking water**, **wastewater**, and **stormwater** infrastructure decisions.

Research Advise Innovate Network

<https://www.epa.gov/waterfinancecenter>

2

Stormwater Funding Task Force

SEC. 4101. STORMWATER
INFRASTRUCTURE FUNDING TASK FORCE

- America's Water Infrastructure Act (AWIA) was signed into law on October 23, 2018.
- Section 4101 calls for EPA to establish a Stormwater Infrastructure Funding Task Force, composed of representatives of Federal, state, and local governments, and private (including nonprofit) entities.

Objective:

To conduct a study on, and *develop recommendations to improve*, the availability of public and private sources of funding for the

construction, rehabilitation, and operation and maintenance of stormwater infrastructure

to meet the requirements of the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.).

3

Stormwater Funding Task Force

SEC. 4101. STORMWATER INFRASTRUCTURE FUNDING TASK FORCE

- The task force was convened through a Federal Advisory Committee – *the Environmental Financial Advisory Board (EFAB)*
- A working group was formed within EFAB, the *Stormwater Infrastructure Finance Task Force Workgroup*
 - This workgroup is responsive to the America's Water Infrastructure Act of 2018, Section 4101.

4

Stormwater Funding Task Force

SEC. 4101. STORMWATER INFRASTRUCTURE FUNDING TASK FORCE

- The Task Force was convened through a Federal Advisory Committee – **the *Environmental Financial Advisory Board (EFAB)***
- ***EFAB accepted the Charge on March 20, 2019***
- To address the Charge, a workgroup was formed within EFAB, the ***Stormwater Infrastructure Finance Task Force Workgroup***
- The ***Task Force first met in June 2019***
- The ***EFAB submitted their recommendations on March 30, 2020***

5

Environmental Financial Advisory Board (EFAB)

STORMWATER INFRASTRUCTURE FINANCE TASK FORCE WORKGROUP

The Stormwater Infrastructure Finance Task Force was tasked to provide recommendations to the EPA in the following areas:

- Identify how funding for stormwater infrastructure from such sources has been made available, and utilized, in each state to address stormwater infrastructure needs;
- Identify how the source of funding affects the affordability of the infrastructure, including consideration of the costs associated with financing the infrastructure;
- Evaluate whether such sources of funding are sufficient to support capital expenditures and long-term operation and maintenance costs

6

EFAB RECOMMENDATIONS

The recommendations present suggestions to use existing funding mechanisms, increase accessibility to those funding mechanisms, identify additional funding opportunities and enhance public education.

Two main categories:

- **Allocate new federal stormwater funding.** Federal grants, loans and new stormwater programs are needed to fund critical stormwater infrastructure in communities of all sizes across the country and support local funding sources.
- **Provide stormwater funding education and technical assistance.** Educating the public and elected officials on the need for stormwater funding is critical to the successful implementation of and community support for funding solutions. In addition, many communities need technical assistance related to evaluating and securing funding and financing mechanisms.

7

EFAB RECOMMENDATIONS

Allocate new federal stormwater funding.

- **Recommendation:** Develop a new and enhanced construction grant program specifically for stormwater projects, similar to the federal Municipal Construction Grants Program that funded the construction of wastewater treatment plants.
- **Recommendation:** Increase annual funding allocation for and modify the Clean Water Act section 319(h) grant program to allow and encourage local capacity building, utility fee study and implementation and asset management, and remove restrictions on use of grant funds for MS4 permit compliance.

8

EFAB RECOMMENDATIONS

Allocate new federal stormwater funding. (cont.)

- **Recommendation:** Provide additional funds for the CWSRF and Water Infrastructure Finance and Innovation Act (WIFIA) programs specifically for stormwater. The CWSRF and WIFIA programs are integral tools among the many infrastructure financing options available to communities.
 - I. Create a specific stormwater set-aside in the existing CWSRF framework and increase awareness/guidance on the CWSRF for stormwater projects, including the Green Project Reserve program.
 - II. Create a “One Water” SRF with amounts allocated to drinking water, clean water and stormwater.
 - III. Create a new SRF program exclusive to stormwater programs and projects.
 - IV. Expand the existing WIFIA program (e.g., explicit references to stormwater project eligibility, priority points for stormwater projects, lower project minimums for bundled stormwater projects) to allow funding for more stormwater projects or fund the Army Corps of Engineers (USACE) Corps Water Infrastructure Financing Program (CWIFP), also established in 2014.

9

EFAB RECOMMENDATIONS

Allocate new federal stormwater funding. (cont.)

- **Recommendation:** Create a federal funding program (similar to the Low Income Home Energy Assistance Program [LIHEAP]) to help address household affordability issues for customers who are economically challenged in paying their water related charges, including stormwater.

Provide stormwater funding education and technical assistance.

- **Recommendation:** Provide funding to educate elected officials, professional administrative leaders and the public on the benefit and need for sustainable local stormwater funding and organizational capacity through, for example, the creation of stormwater utilities or the expansion of existing utilities into the stormwater sector.


10

EFAB RECOMMENDATIONS

Provide stormwater funding education and technical assistance. (cont.)

- **Recommendation:** Provide **technical assistance and funding to help communities** create and maintain sustainable and legally defensible funding sources and increase operational efficiency. This could include assistance with funding need assessments, organization analysis, grant applications, affordability assessments, integrated planning and/or establishing revenue instruments.
- **Recommendation:** Provide for a **common application** for different federal grants applicable to stormwater across all federal agencies.
- **Recommendation:** Provide funding to **build and maintain a compendium of case studies and other resources** to assist users to identify successful stormwater funding and financing approaches.

11



Next Steps

- EPA is required to submit a **Report to Congress** describing the results of the Task Force's study and resulting recommendations.
- EPA is looking forward to implementing recommendations as appropriate.
- Additional information coming soon!

12

Sonia Brubaker
Director
U.S. EPA Water Finance Center
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WEF Stormwater Institute
Stormwater Policy Forum Part II
May 4, 2020

**MS4 “Maximum Extent Practicable”
Implementation Update**

Christopher D. Pomeroy, Esq.
President



14

Presentation Overview

◆ Applying the CWA's MEP Standard at Permit Reissuance

- Explanation of the Approach
- Case Study: Maryland MS4 Permits

◆ Applying the CWA's MEP Standard During Permit Term

- Explanation of the Approach
- Case Study: Massachusetts (and NH) MS4 General Permit

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The Clean Water Act's MEP Standard

“Permits for discharges from MS4s . . . shall require controls to reduce the discharge of pollutants to the **maximum extent practicable**, including management practices, control techniques and system, engineering and design methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants.”

-- CWA § 402(p)(3)(b)(iii); 33 U.S.C. § 1342(p)(3)(B)(iii)

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MEP Is a Community-Specific Determination

- **CWA & EPA Regulations Do Not Define MEP**
 - Intent is for each MS4 to address on case-by-case basis
- **Considerations In Determining MEP**
 - Condition of receiving waters
 - Specific local concerns
 - Other aspects of comprehensive watershed plan
 - MS4 size
 - Implementation schedules
 - Ability to finance
 - Capacity to perform O&M
 - Hydrology/geology
 - EPA Phase 2 Rule Preamble, 64 Fed. Reg. 68722, 68754 (Dec. 8, 1999)

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Applying MEP at Permit Reissuance

- **Elements of MEP Analysis (MEPA)**
 - Evaluate the MS4 Program's capability
 - Make provision-by-provision and aggregate analyses
 - Determine maximum practicable effort of same
- **Benefits of Thorough MEPA**
 - Provides a framework for decision making
 - Documents a sound basis for permit development

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Examples of MEP Analysis

- **Permit-Required Timing & Schedules**
 - Ex: For TMDL implementation projects, are any specified timelines practicable considering the component parts such as planning, siting, engineering design, easement acquisition, financing, public procurement requirements, and construction steps?
- **Permit-Required Spending & Tax/Fee Increases**
 - Ex: Are overall costs practicable for the community residents?
 - Ex: Are increased costs, if any, practicable for community residents (i.e., required tax or stormwater fee increases)?
 - Ex: How does the rate and magnitude of cost increases for MS4 Permit compare to other needs and increases in the community?

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VA Ches Bay N&P (GP & IPs Permits)	MD Ches Bay N&P (IPs, Similar GP)	MA Charles River P (GP, Later IPs)
Mass Load Reductions 1 st Cycle: 5% 2 nd Cycle: 40% 3 rd Cycle: 100%	Surrogate: Impervious Surface Area Retrofits By Yr 5, retrofit 20% of jurisdiction-wide I.S.	Yr 5: Complete Planning Yr 8: 20% Yr 10: 25% Yr 13: 30% Yr 15: 50%
Permittees in 1 st or early 2 nd cycle; so far, so good	acreage not already treated to the MEP	Yr 18: 70% Yr 20: 100%
High compliance rate	Noncompliance Issues	20 years purported locked- in by 5-yr NPDES permit
No litigation	Litigation	Litigation

20

Maryland MEPA Example

◆ 1st Case (Frederick Co. Phase I MS4 Permit)

- ~ Prior permit constituted for a \$12M (5yr total) effort
- ~ Permit required 12x spending increase to \$145M
- ~ MEPA indicated MEP = 4x cost increase to \$45M
- ~ OUTCOME: Sharply divided (4-3) Maryland high court allowed “Beyond MEP” requirements to stand (Aug. 2019)

◆ 2nd Case (Small MS4 General Permit)

- ~ Same TMDL implementation scope, slight longer schedule as Phase I MS4s
- ~ 3 representative Small MS4s have appealed similar and additional issues
- ~ STATUS: Appeal is pending in MD intermediate appellate court, with a petition now pending with the MD high court to take the case up directly

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Special Issues with General Permits

◆ How to Apply Case-by-Case MEP in GP?

- ~ Avoid one-size-fits-all TMDL implementation provisions in permit
- ~ Instead establish TMDL planning under permit for review & approval

◆ Alternative A – Shift to Individual Permit

- ~ But can be inefficient for regulatory agencies especially

◆ Alternative B – Add Adjustment Process to GP

- ~ Set default one-size-fits-all approach
- ~ Provide a process for MEP-based alternative to be developed under permit for review and approval
- ~ This is the approach in the MA and NH permit modifications in process

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MA Small MS4 General Permit: Settlement Agreement & Pending Modifications

◆ EPA Issued Permits

- ◆ Important national recognition of role of MEP standard in managing WQS and TMDL implementation



◆ Original Permits

- ◆ Reduce discharge of pollutants so as not to cause or contribute to water quality standards exceedance
- ◆ Includes fixed 20-year schedule for meeting periodic numeric reduction milestones and full TMDL compliance by Year 20

◆ Two-Year Multi-Party Mediation 2017-19

- ◆ Local Governments (MCWRS), Homebuilders, CRR
- ◆ Regulators - EPA R1 & EPA HQ (MassDEP)
- ◆ Environmental Groups (CLF, CRWA)



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2.1. Water Quality Based Effluent Limitations

Pursuant to Clean Water Act 402(p)(3)(B)(iii), this permit includes provisions to ensure that discharges from the permittee's small MS4 ~~do not cause or contribute to an exceedance of meet applicable~~ water quality standards ~~as set forth in part 2.1.1. below.~~ ~~in addition to requirements to reduce the discharge of pollutants to the maximum extent practicable. The requirements found in this part and part 2.2 constitute appropriate water quality based effluent limits of this permit. Requirements to reduce the discharge of pollutants to the maximum extent practicable are set forth in part 2.3.~~

2.1.1. Requirement to Meet Water Quality Standards

- a. The permittee's discharges shall meet applicable water quality standards by complying with parts 2.1.1.b and/or 2.1.1.c in accordance with the schedules set forth therein.² Any other discharge of a pollutant that: (i) is not addressed by part 2.1.1.b, part 2.1.1.c, part 2.2.1, and/or part 2.2.2, (ii) is not the result of an illicit discharge subject to part 2.3.4, and (iii) does not meet applicable water quality standards, either independently or in conjunction with other discharges, shall comply with part 2.1.1.d. permittee shall reduce the discharge of pollutants such that the discharges from the MS4 do not cause or contribute to an exceedance of water quality standards.

No Strict
"Cause or
Contribute"
Prohibition

Instead, Meet
Default TMDL
Implementation
Schedule

OR, If That Is
Impracticable,
Adjust to a
Practicable
Level with
Documentation

24

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Adjustment Process: Alternative Schedule

- b. If there is a discharge from the MS4 to a waterbody (or its tributaries in some cases) that is subject to an EPA approved or established TMDL identified in part 2.2.1, the permittee is subject to the requirements of part 2.2.1 and Appendix F of this permit and the permittee shall comply with all applicable schedules, alternative schedules and requirements in Appendix F. A permittee's compliance with all applicable requirements and BMP implementation schedules in Appendix F or any alternative schedules applicable to it will constitute compliance with part 2.1.1.a. of the Permit for discharges of pollutants addressed in Appendix F.

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Practicability- Based Alternative Schedule

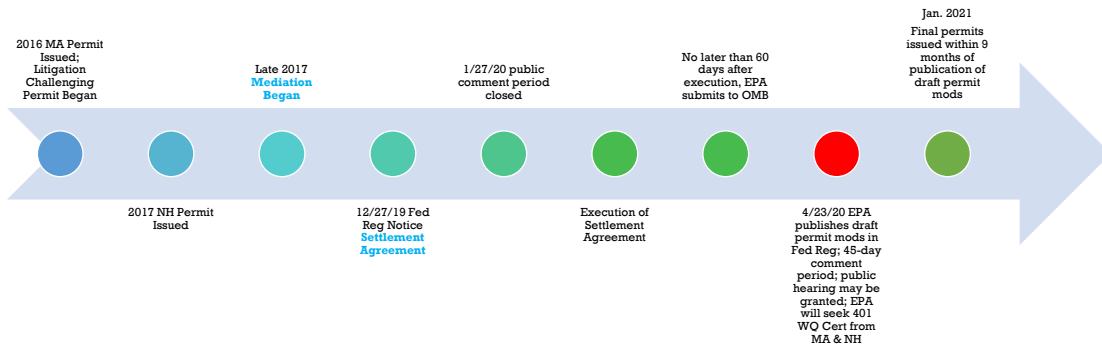
If permittee determines schedule to meet required Phase 2 phosphorus reductions is impracticable, permittee may submit an Alternative Schedule Request to meet requirements on the shortest schedule. Request shall include:

- Reasons for request including information demonstrating applicant's efforts and extent of progress made toward meeting the required phosphorus reductions;
- Description of planned structural controls to meet applicable phosphorus reduction milestones;
- Suitability and availability of areas for siting and constructing structural controls, including, if appropriate, a review of third-party partnerships considered for within-watershed structural control sites;
- Access and acquisition of real property rights for constructing and maintaining structural controls;
- Timelines for the permittee's planning, design, financing, easement or property interest acquisition, and procurement for and construction of structural controls;
- Timelines for and constraints due to the federal, state and/or local approval(s) and permitting processes for structural controls;
- Anticipated phosphorus reductions due to the rate of redevelopment within the community and the degree to which future redevelopment may be reasonably anticipated to achieve the desired reductions in lieu of reliance upon structural controls by the permittee,
- Estimated cost of the planned structural controls to meet applicable phosphorus reduction milestones;
- Scale of structural BMP controls required and phasing considerations with other capital improvement projects that are being implemented by the permittee or other parties that impact the permittee, municipality or relevant taxpayers or ratepayers;
- Affordability for taxpayers/ratepayers including a projection of sources and uses of funds, taking into consideration existing or potential financial capability and funding mechanisms;
- Other relevant information, and
- A requested schedule to meet all phosphorus reduction requirements.

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26

Timeline & Status



27

27

Questions?

Christopher D. Pomeroy, Esq.
President – AquaLaw PLC

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(804) 716-9021 x202
chris@AquaLaw.com



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Agriculture/Stormwater Nexus Dynamics

Stormwater Policy Forum

Steven Rowe, CEO
Newtrient LLC
May 4, 2020



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NEWTRIENT'S MISSION

*Reduce the environmental footprint of dairy and
make it economically viable to do so.*



30

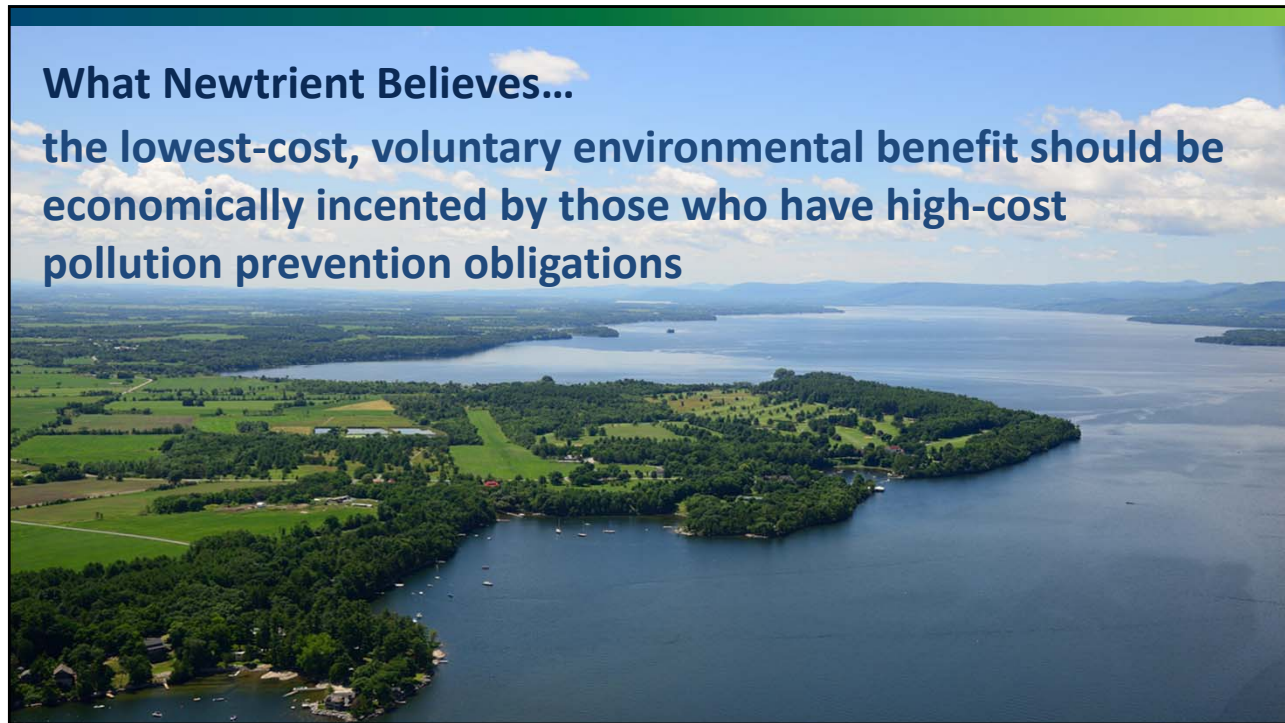
Represented by Dairy Cooperatives and Companies



31

What Newtrient Believes...

the lowest-cost, voluntary environmental benefit should be economically incented by those who have high-cost pollution prevention obligations



32

Most Promising Ecosystem Service Markets Today

ECOSYSTEM SERVICES



ECOSYSTEM SERVICES BUYERS

RENEWABLE ENERGY

WATER QUALITY

WATER QUANTITY

AIR QUALITY

GHG REDUCTION

CARBON SEQUESTRATION

SOIL HEALTH

RECREATION

WEATHER RESISTANCE

BIODIVERSITY

REGULATED

MUNICIPALITIES

PERMIT HOLDERS

STATES

NON-REGULATED

NON GOVERNMENTAL ORGANIZATIONS

PHILANTHROPISTS

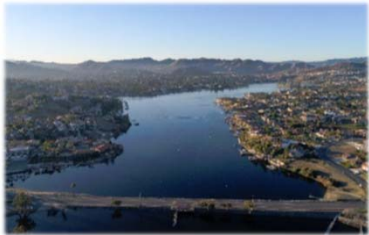
COMPANIES WITH CORPORATE SOCIAL RESPONSIBILITY (CSR) GOALS

INVESTORS

33

Market-Based Programs Surging Globally

· J aredop dunhw#ru#frv | vhp #vhuylfhv#xuj hv#r#
 ' 69075#e loqr#q#lqqxdw#udqvdfwlrqv |
 · ryhu#883#surjudp v#duh#dfwyh#z rugz lgh |
 · z dhvkhgv#kdv#kh#dujhvw#yroxp h#i#j aredop#udqvdfwlrqv/#
 z lk# 571: #e loqr#q#lqqxdw#udqvdfwlrqv#lqqxdw#%



34

National Support Opens Window of Opportunity



December 2018

USDA, EPA Partnership Supports Water Quality Trading To Benefit Environment, Economy



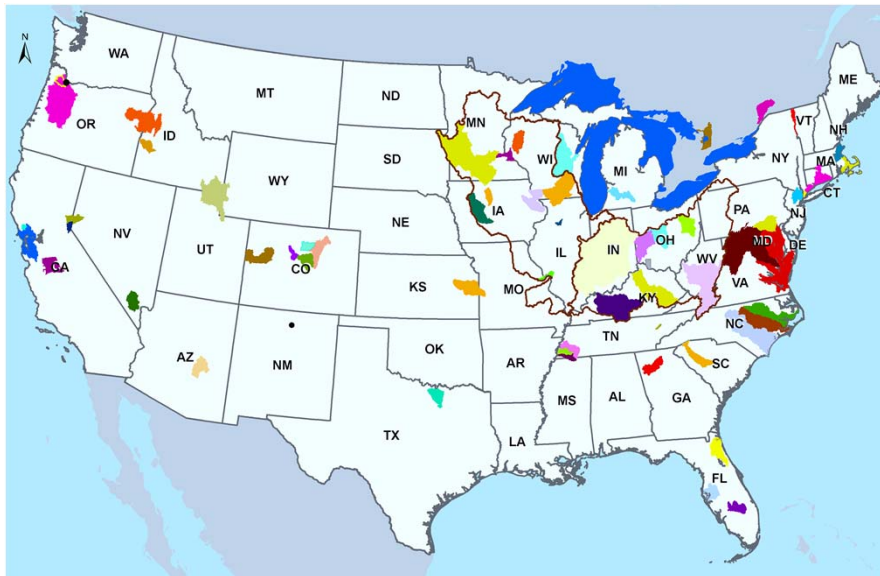
February 2019

EPA Announces New Water Quality Trading Policy Memorandum

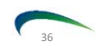
EPA efforts seek to modernize the agency's water quality trading policies to leverage emerging technologies and facilitate broader adoption of market-based programs

35

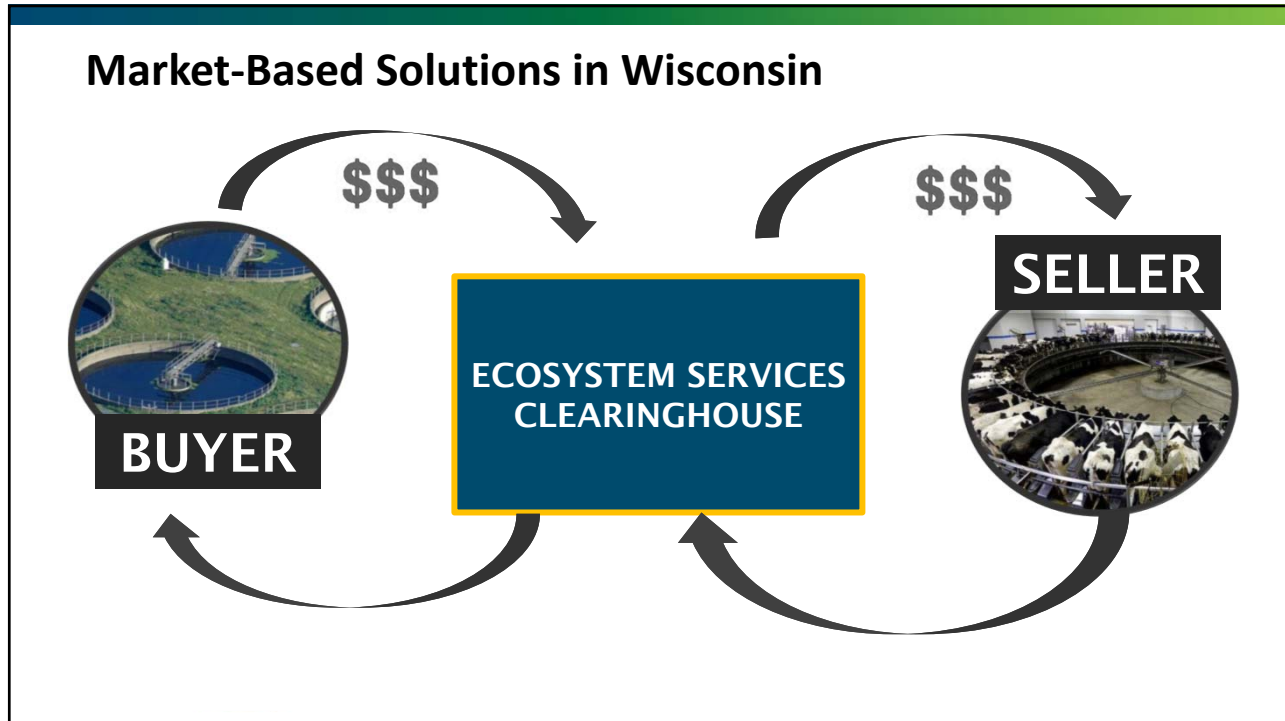
Years of Water Quality Market Attempts



Kieser & Associates, LLC



36



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Wisconsin Legislation Moving Forward in Support of Water Quality Trading



WISCONSIN PUBLIC RADIO
Wisconsin and the World. npr

Farmers, Environmentalists Applaud Legislation To Change Water Quality Trading

"Companies like Newtrient have rolled up their sleeves and are working with dairy farmers and the state to find financially sustainable ways to improve water quality." – John Holevoet (DBA)





"I am encouraged to see continued attention on solutions that will reduce the phosphorus pollution that plagues our waterways." – Amber Meyer Smith (VP, Clean Wisconsin)

"A more flexible marketplace for permit holders could be a win-win for landowners, the agriculture economy and land and water conservation" – Mary Jean Hutson (State Director, TNC)



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Current Water Quality Programs in Wisconsin

Wisconsin has built a strong foundation of water quality programs to protect and enhance the state's water.

WI WATER QUALITY PROGRAMS	Adaptive Management (AM)	Phosphorus compliance program
	Water Quality Trading (WQT)	Market-based option for compliance
	Multi-Discharger Variance (MDV)	Temporary phosphorus variance program for point source dischargers



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Dairy Technology and Practices Deliver Ecosystem Benefits

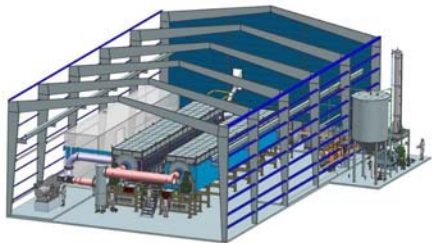
Bio-Filtration (Nitrification/Denitrification)



Dissolved Air Flootation (DAF)



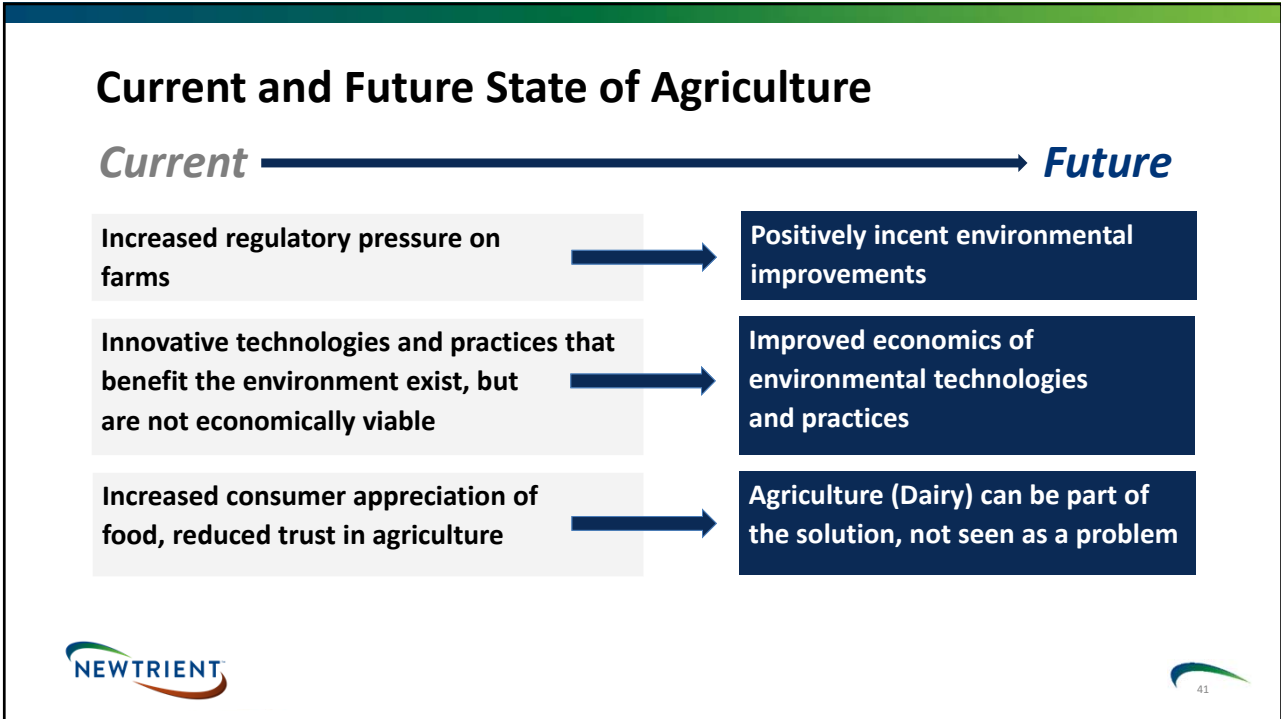
Evaporative



Conservation Buffers



40



41



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QUESTIONS



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Urban Stormwater Runoff as Pathway of Extensive Mixed Contaminants to Surface and Groundwaters in the United States



Stormwater Policy Forum Part 2

Jason R. Masoner, Dana W. Kolpin, Paul M. Bradley, Isabelle M. Cozzarelli, David S. Burden, Richard Lowrance, Matthew E. Hopton, Larry B. Barber, William A. Battaglin, Angela K. Brennan, David J. Fairbairn, Shawn C. Fisher, Kenneth J. Forshay, Edward T. Furlong, Justin F. Groves, Michelle L. Hladik, Jeanne B. Jaeschke, David P. Krabbenhoft, Kristin Romanok, David L. Rus, William R. Selbig, Brianna H. Williams

Acknowledgements

- This presentation and project described would not have been possible without collaboration from numerous municipalities across the country who provided access to stormwater infrastructure.
- The views expressed are those of the author[s] and do not necessarily represent the views or policies of the U.S. Geological Survey or U.S. Environmental Protection Agency.



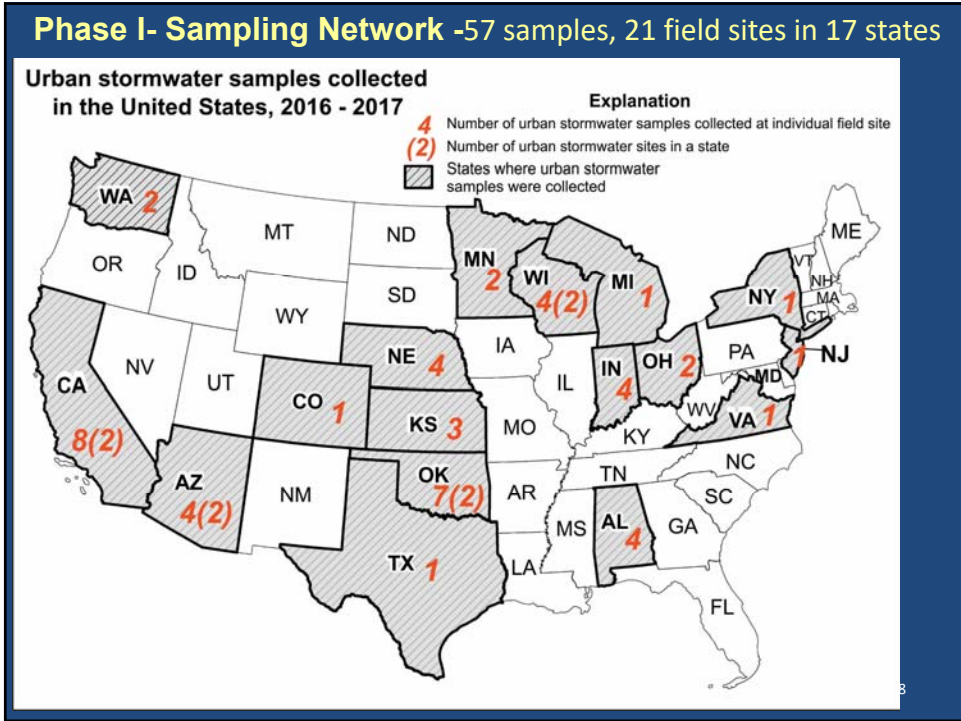
6

Broad Suite of Organic (438) and Inorganic (64) Chemicals Targeted

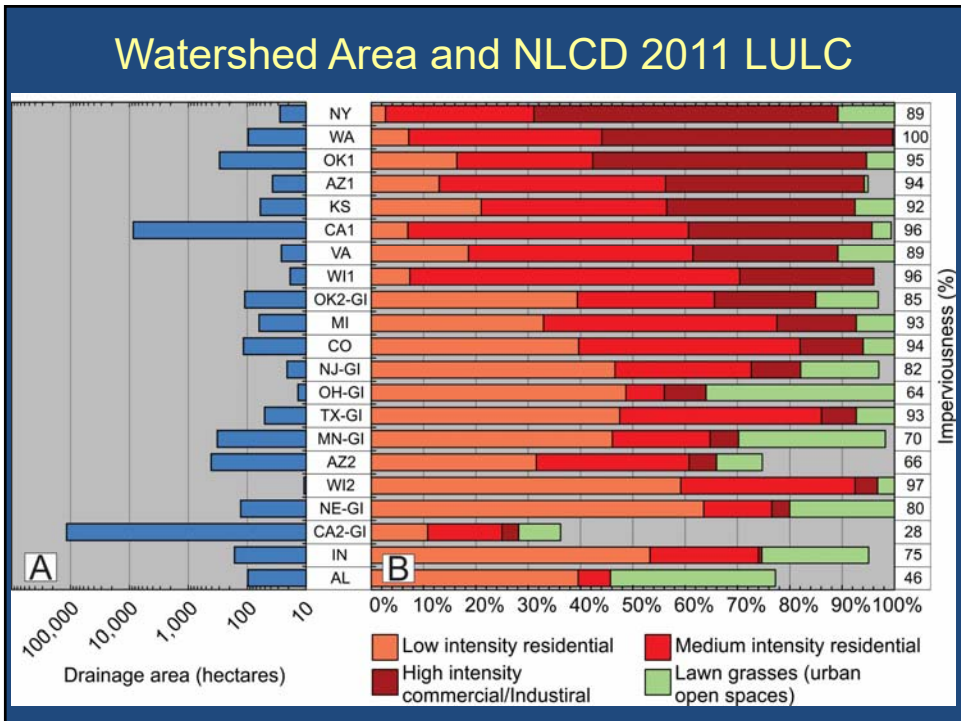
- PAHs (20): chrysene
- Prescription pharms (88): metformin
- Nonprescription pharms (19): acetaminophen
- Household chemicals (21): galaxolide
- Industrial chemicals (58): triphenyl phosphate
- Pesticides (183): imidacloprid
- Hormones (21): estrone
- PCBs (28): polychlorinated biphenyl 180
- Inorganics (64) and methyl mercury



7



8



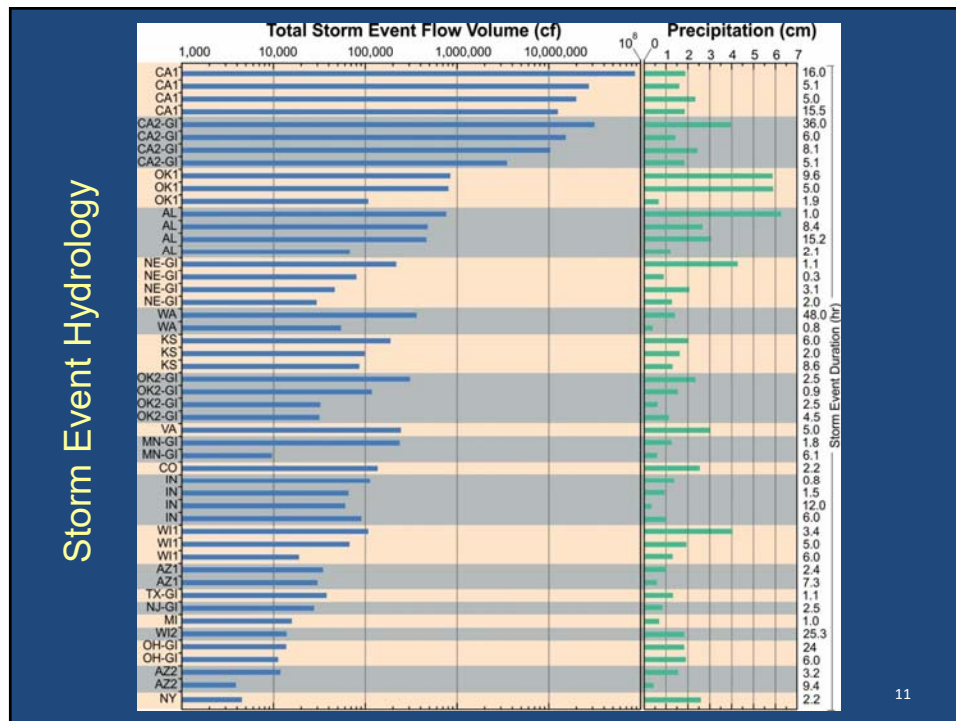
9

Network and Sampling Details

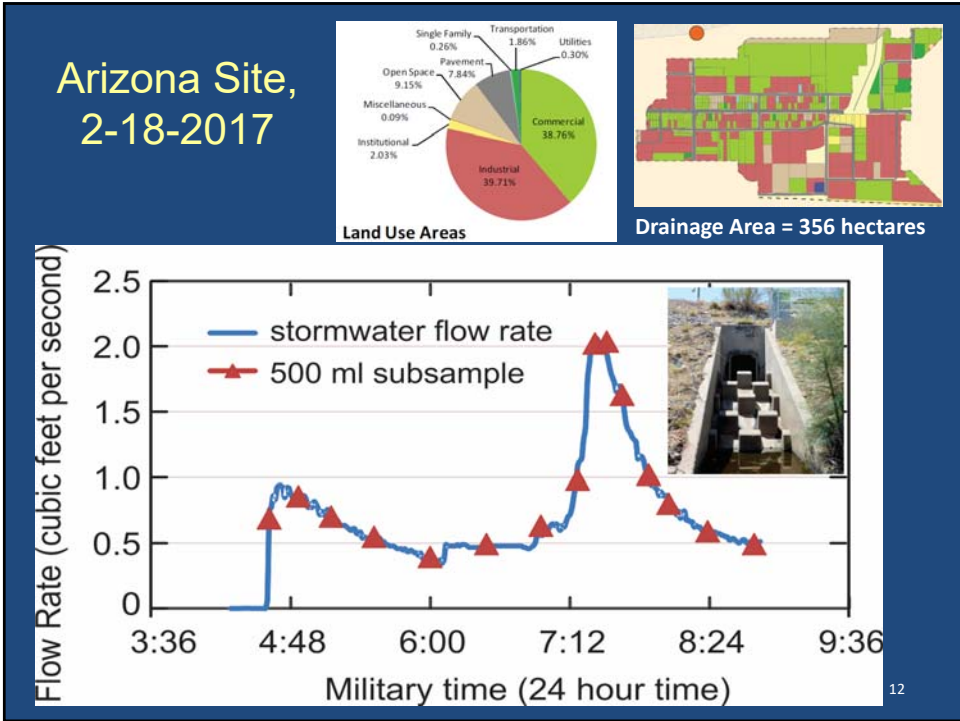
- Goal was to sample urban stormwater runoff, no combined sewage/storm infrastructure.
- 40% of sites infiltrated urban stormwater to GW via GI.
- Auto sampler used for flow-weighted composite samples.
- 3 sites used DH-81 sampler for time-weighted isokinetic samples.



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Organic Chemical Results

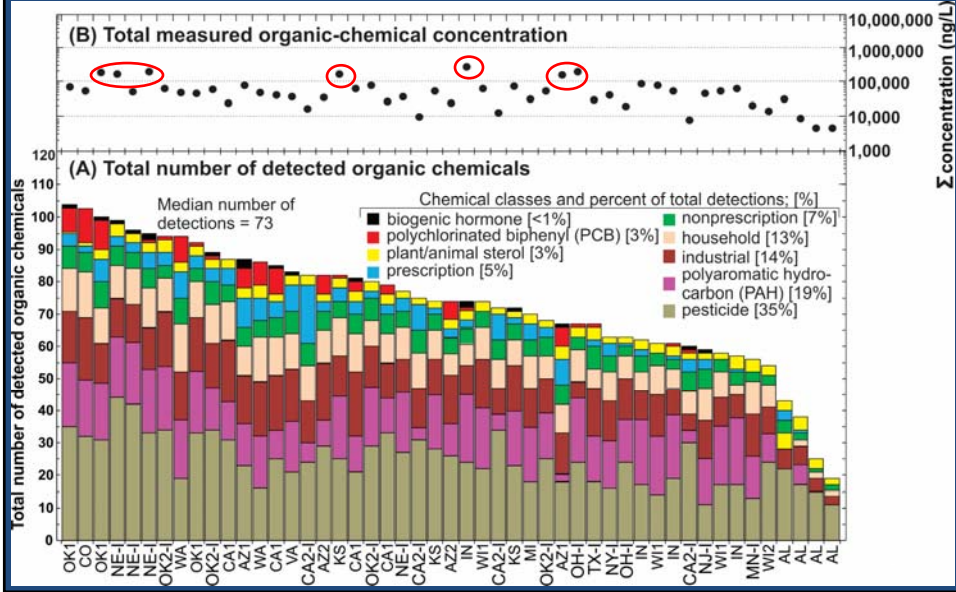
438 organics analyzed, 215 detected

Household chemicals	<ul style="list-style-type: none"> • DEET (98%, max concentration of 109,000 ng/L) • Bisphenol A (90%, 2,770 ng/L)
PAHs	<ul style="list-style-type: none"> • Fluoranthene (90%, 36,700 ng/L) • Pyrene (90%, 29,100 ng/L)* • Caffeine (96%, 32,300 ng/L)
NP-pharms	<ul style="list-style-type: none"> • Nicotine (98%, 18,300 ng/L) • Cotinine (92%, 550 ng/L)
Pesticides	<ul style="list-style-type: none"> • Carbendazim (94%, 9,580 ng/L)* • Desulfenylfipronil (90%, 20 ng/L)
Industrial chemicals	<ul style="list-style-type: none"> • Methyl-1H-benzotriazole (92%, 6,790 ng/L) • P-cresol (92%, 1,310 ng/L)

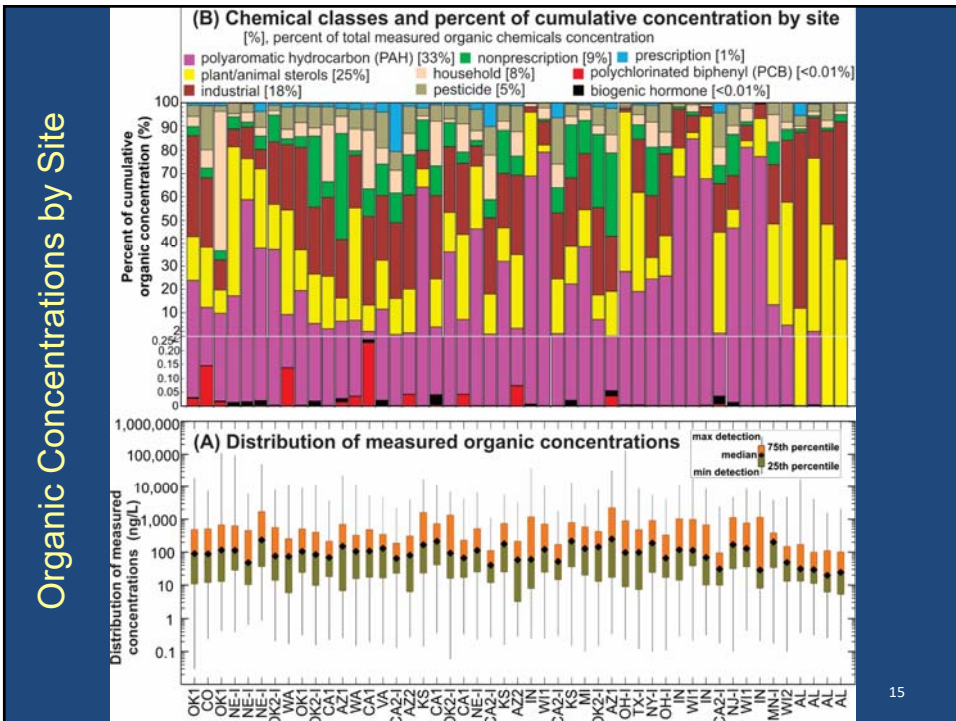
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Number of Detected Organics by Chemical Class

- Detected in every sample (18 to 103)
- Median CECs detected = 73



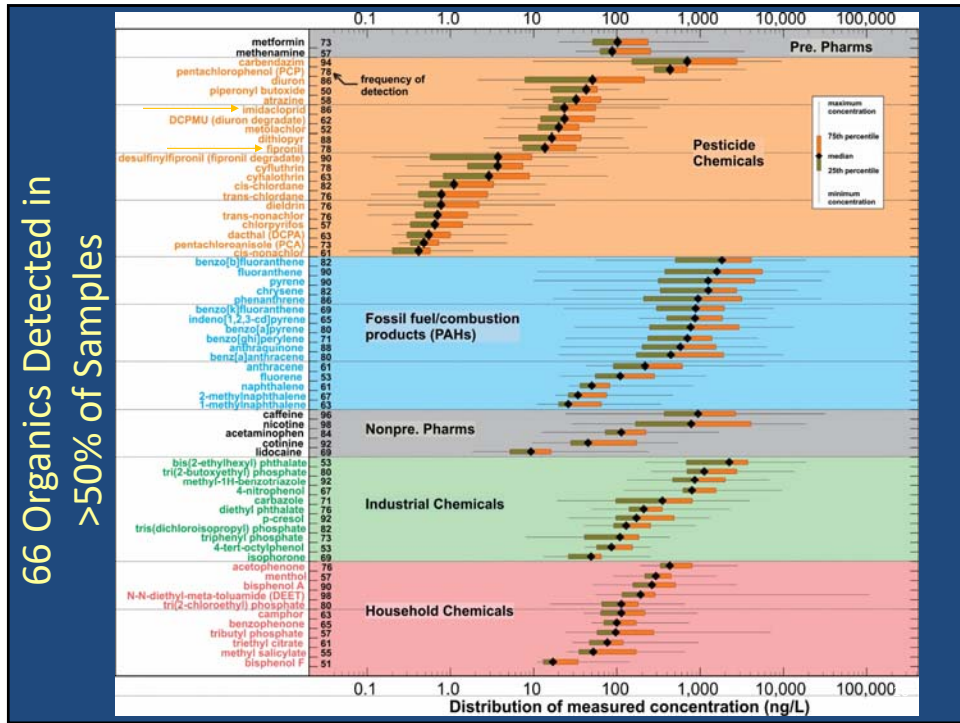
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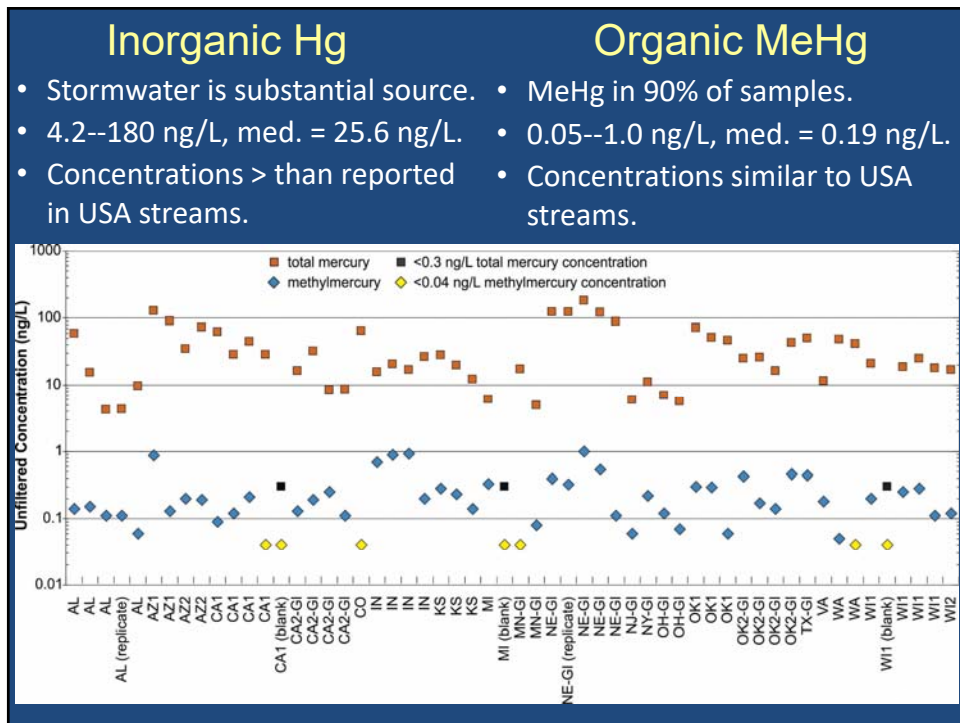
Organic Concentrations by Site

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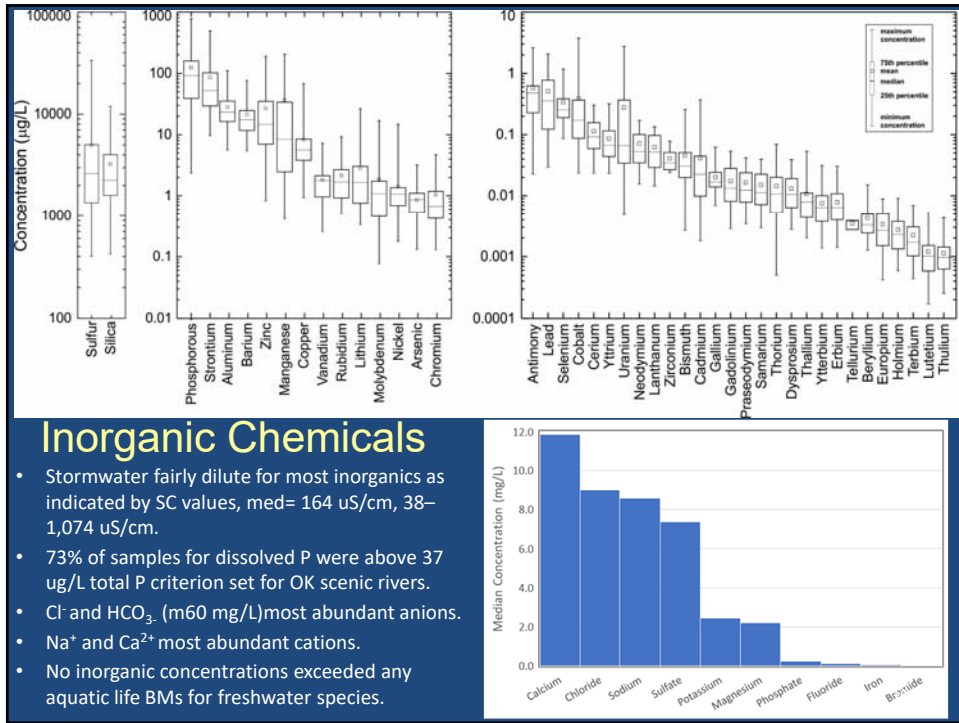
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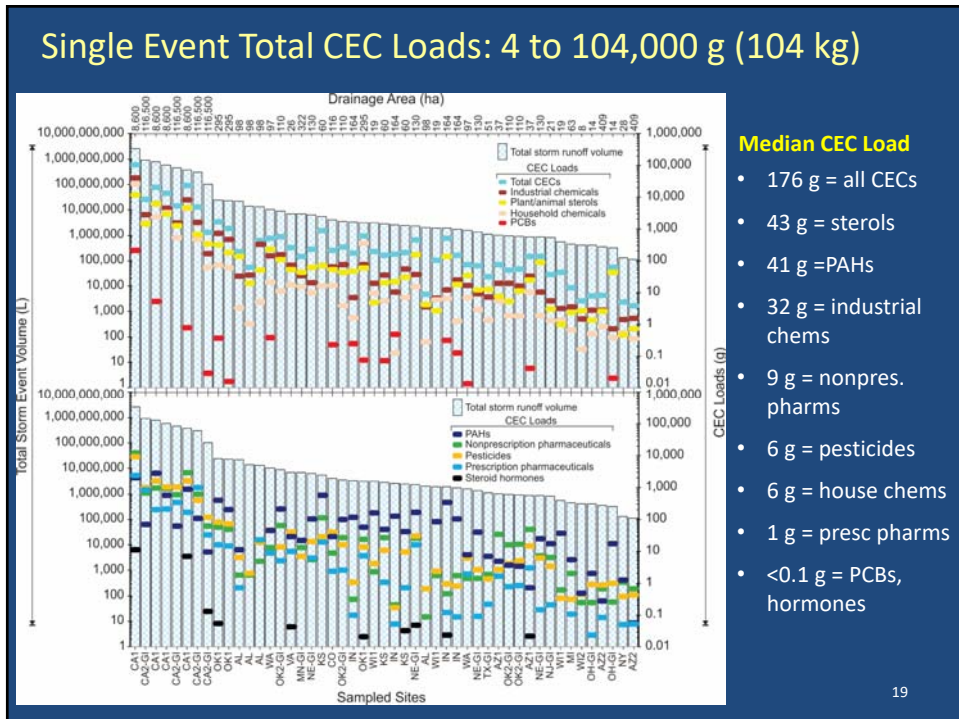
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Quantitative Comparison of Organic Loads in Untreated Stormwater and Treated Wastewaters

- 28 single-event storms (5 hours) with runoff volumes (1 - 25 M L/event), comparable to daily treatment capacity of small WWTP (30 M L/d).
- 8 single-event storms (12 hours) with runoff volumes (0.1 – 2.5 B L/event), comparable to daily treatment capacity of medium to large WWTP (870 M L/d).
- Organic loads from single-event (med duration = 7 hours) stormwater runoff volumes compared to daily WWTPs volumes indicate that episodic stormwater runoff events can potentially contribute:
 - substantially larger loads of PAHs and pesticides;
 - similar loads of household chemicals, industrial chemicals, and nonprescription pharmaceuticals;
 - substantially smaller loads of prescription pharmaceuticals, biogenic hormones, and plant animal sterols.

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Implications for Stormwater Management

- Stormwater is transporting a extensive mixture of organic chemicals.
 - Detections: pesticides > PAHs > industrial chems > household chems > nonpres pharms > pres pharms > sterols > PCBs > biogenic hormones.
 - Numerous detections per site (median of 73 compounds).
 - Many known or suspected carcinogens, endocrine disrupting, and bioactive.
- Organic chemicals are present in stormwater at widely variable individual-component and cumulative-mixture concentrations.
 - Concentrations: PAHs > sterols > industrial chems > nonpres pharms > household chems > pres pharms > pesticides > PCBs ~ biogenic hormones.
 - Concentrations spanned 6 orders of magnitude < 1 to 100,000 ng/L.
 - Little is known about mixture-effects from exposure of low ng/L concentrations.
 - Some PAHs and pesticides exceeded aquatic BM levels.
 - 7 samples had cumulative-mixture concentrations >100,000 ng/L.
- Organic concentrations and single storm-event loads were comparable to and often exceeded those of daily WWTP discharges.

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Implications--continued..

- Largest organic-contaminant sources originate from impervious surfaces and developed medium-intensity and high-intensity urban centers.
- Evidence from anthropogenic/background gadolinium ratios coupled with frequent detections of metformin, lidocaine, and acetaminophen in urban stormwater, indicates a human sewage source.
- Stormwater is a consistent source of inorganic Hg and could pose negative implications for some SCM and GI projects (wetlands/bioretention ponds) that may provide conditions for methylation to MeHg.
- MeHg concentrations in urban stormwater indicate that stormwater infrastructure provides favorable conditions for conversion of inorganic Hg to highly toxic organic form (MeHg).



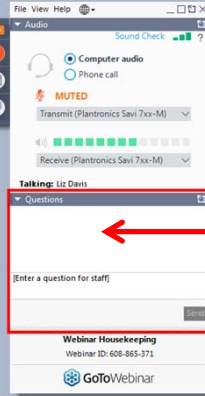
22

Masoner, J.R., et al., 2019, Urban Stormwater: An Overlooked Pathway of Extensive Mixed Contaminants to Surface and Groundwaters in the United States. *Environmental Science & Technology*, 53 (17), 10070-10081

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Open Discussion and Feedback via Chat Function



- **Audio Modes**
 - Listen using Mic & Speakers
 - Or, select "Use Telephone" and dial the conference (please remember long distance phone charges apply).
- Submit your questions using the Questions pane.
- A recording will be available for replay shortly after this webcast.

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Water Week 2020 Recordings

- The **Stormwater Asks for Water Week 2020** and the **Stormwater Policy Forum** webcast recordings, as well as the Stormwater Ask Document, are all available on the SWI website:
<https://wefstormwaterinstitute.org/programs/water-week-2020-stormwater-events/>
- The Water Week 2020 **Policy Fly-In Advocacy** and **Insights from Washington, DC** webcast recordings are available on the Water Week website:
<https://www.waterweek.us/>

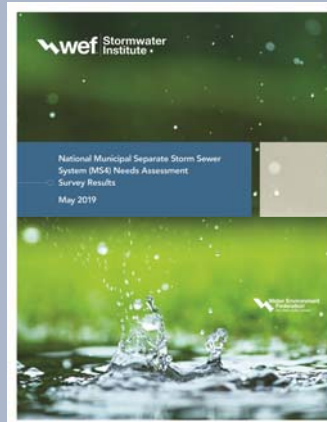
National Municipal Stormwater and Green Infrastructure Awards



- Recognizes high-performing regulated MS4s that meet and exceed regulatory requirements in innovative ways
- Nomination Deadline TODAY! Monday, May 4th
- <https://wefstormwaterinstitute.org/programs/ms4awards/>

National MS4 Needs Assessment Survey

- This year, the second iteration of the survey will take the pulse of the U.S. stormwater sector in search of up-to-date information on permittee characteristics, obstacles, and opportunities.
- Accepting responses through the end of May
- <https://wefstormwaterinstitute.org/programs/ms4survey/>



Stormwater Digital Conference

Available Now! An online course featuring recorded videos from the presentations set to present at the National Stormwater Symposium. The following five sessions provide a wide range of engaging and innovative topics:

- Stormwater Worldwide
- Performance of Post-Construction Control Measures
- Influence and Action - Outreach, Education, and Training Strategies
- Program Development, Planning, Management, and Analysis
- Sustainable Solutions to Climate and Flooding

<https://www.wef.org/resources/online-education/digitalprogramming/>

